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# The Mining Journal

LONDON, APRIL 17, 1959

Vol. 252. No. 6452.

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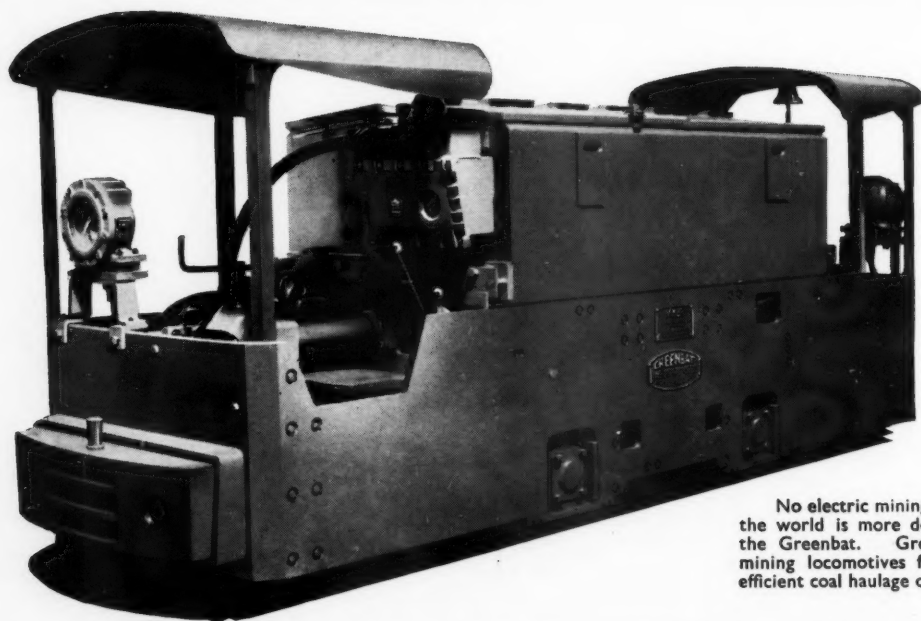
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# The Mining Journal

London, April 17, 1959

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Vol. 252

No. 6452

Established 1835

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Published each Friday by

## THE MINING JOURNAL LTD.

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15 WILSON STREET,  
LONDON, E.C.2

Telegraphic  
Tutwork London

Telephone  
MONarch 2567 (3 lines)

Annual Subscription £3 5s. Single copy ninepence

## For What Are We Training Our Geologists ?

MOST of those who read geology do so primarily because the subject interests them. Nevertheless, immediately after graduating, or after a further few years spent in studying a particular topic with a view to learning the art of research and acquiring a higher degree, the vast majority have to earn their living.

The majority of practising geologists are to be found in universities, technical institutes, schools of mines, geological surveys, and in the mining, oil and engineering industries, and it is clear that all of them must be concerned, to a greater or lesser extent, with minerals of economic importance. Of these a considerable proportion hold degrees in "pure" geology—not in applied or mining geology—obtained at British universities. Do the courses in British universities generally measure up to the present-day demands upon such geologists ?

In order that a geologist shall possess the fundamental knowledge necessary to become of real use to the metal-mining industry (here the expression is used in the widest possible sense) soon after he leaves the university, it is surely essential that he should have received considerable instruction not only in the major branches of geology but also in such subjects as surface and underground mapping, ore deposits, mineral identification, and geophysical and chemical aids, which will be of practical assistance and value in his future work.

It is regrettable, therefore, that there appear to be many schools of geology in the United Kingdom—there are, of course, notable exceptions—where the economic aspect is neglected. Too little time is spent in studying the minerals of economic importance and examination of these by modern techniques is apt to be largely ignored, as is underground mapping.

An over-academic approach to the training of geologists tends to produce the type of graduate—by no means unfamiliar to the mining industry—who has an excellent knowledge of the examination of rocks in thin section, is quite good at routine field mapping, is *au fait* with the currently held views of petrogenesis, sedimentation and geologic structure, yet is unable to identify such common, but economically important minerals as galena, sphalerite or siderite when they occur in poorly crystallized materials in the field. In mining territories overseas one sometimes comes across young geologists who are excellent field men but do not appreciate the economic aspect of their work. Due to the limitations of their training they are liable to conclude, for example, that a little cassiterite panned from a river signifies the discovery of a new mining field !

There is good reason for believing that, in the British universities, the geology student receives sufficient instruction and practice in surface mapping of "normal" (as opposed to "mineralized") geologic bodies to acquire the fundamental techniques which, with experience, will enable him to become an expert in this field. On the other hand, it would appear that underground mapping is often



completely ignored in degree courses. It is difficult to understand why this should be so since there are many mines operating in the United Kingdom, and many more in the readily accessible countries overseas, and the technique of underground mapping is not difficult to master. Furthermore, underground studies can be very beneficial to all geologists, since in the mines one has access to unweathered rock and, in addition, three-dimensional "pictures" of structures and deposits can often be obtained which are far more meaningful than those obtained purely by surface exploration.

As regards ore deposits, if it is accepted that these are simply somewhat unusual products of igneous, sedimentary and metamorphic processes which are of particular interest to man because he obtains materials from them which can sustain his rapidly accelerating technological and other advances, it follows that their study cannot be neglected if a true appreciation of the rock-forming processes is to be obtained. Can any logical reason be given for studying, for example, the development of the Permo-Carboniferous granites and associated minor intrusives of the south-west of England, and ignoring the lodes which are almost certainly genetically related to them, and which, in the eyes of many, are the products of the last act of a great igneous drama.

Moreover, a comprehensive study of the ore deposits is surely justified by the fact that many of those who graduate in "pure" geology join mining companies and geological surveys, and so work on projects in which ore deposits can rarely be ignored and, indeed, are often at the foci of the investigations. In this connection it is pertinent to state that most of the obvious ore deposits have already been found, and those who are to search successfully now must be really adequately trained.

Of course, those wishing to defend a course of instruction in which such subjects as the study of ore deposits, underground mapping, and mineral identification, are largely neglected, may well say that time does not permit everything to be included in a curriculum, and if new subjects are included others must be deleted. This is a glimpse of the obvious, but can nothing be deleted, or perhaps dealt with in a briefer manner? Is it possible that some of the subjects we have mentioned are too "commercial" to find favour in some academic circles.

If it is conceded that the study of ore deposits by all students of geology—except, possibly, those majoring in palaeontology—is worthwhile, it follows that adequate training must be given in the more important methods of identifying the ore minerals. It is probably true to say that only a small proportion of those who graduate in geology each year are familiar with the methods of identifying opaque minerals in polished sections: yet the majority of economically important minerals are opaque. It is also questionable whether the majority are truly *au fait* with the most useful physical and chemical methods of identifying minerals generally, and particularly the opaque species. It is a common experience among mining companies that most graduates are not good at determinative mineralogy of the kind necessary to recognize ore minerals in the field where weathering, etc., complicates matters: this is doubtless due to the common tendency to restrict laboratory work in determinative mineralogy largely to the study of "fresh" well-crystallized material.

It is important not to forget that the recognition of lode outcrops and the determination of their mineralogical characteristics is important to all geologists engaged in mapping "new" areas, regardless of the purpose for which the maps are being prepared.

It is difficult, also, to see how really adequate petrological studies can be carried out unless those concerned with the

work are capable of identifying the major and minor opaque species encountered in addition to the transparent minerals.

The elucidation of the mineralogical character of alluvials is of the utmost importance both to the pure and the applied geologist, but can it be said that fragmental petrology—which must include study of the resistant opaque minerals—is generally given really adequate attention in degree courses?

Of course, there are those who argue that the geologist collects the material and the mineralogist identifies the minerals in the collection. Is this a truly satisfactory state of affairs? Can one be a really proficient petrologist without being, at the same time, a good mineralogist?

Whilst it is quite impracticable in a three-year course to produce a geologist who is also an adequate applied geophysicist or geochemist, the student can, at least, be made fully aware of how geophysics and geochemistry can facilitate the search for sub-outcropping ore and how and when they can be profitably employed in general mapping programmes. Furthermore, is there any fundamental reason why students of geology should not become familiar with geochemical and geophysical techniques by attending compulsory field vacation courses on these subjects? Little instruction is necessary to conduct simple radiometric, self-potential and resistivity surveys, and the necessary equipment is not expensive. Similarly, the analytic methods on which geochemical surveys depend are rapid and simple, and can be carried out without difficulty by those who have studied chemistry to G.C.E. advanced level.

The importance of air photographs to the geologist is so well known that it is unnecessary to stress it here, but are they generally receiving the attention in geology courses which they merit?

Is the exploration of hard rock by diamond drilling and of alluvials by Banka drilling, and allied methods, covered in most geology courses? Certainly they are important to the majority of geologists.

Assuming that these comments on the geology curricula at many British universities are substantially correct, it would seem that considerable changes should be made in the manner of training geologists if they are to contribute significantly to a subject which is daily growing more complex. Without knowledge of the topics here discussed, how can the young geologist attempt to "understand the veins, stringers, and seams in the rock" or, indeed, the rock itself?

## RECENT EXPANSION IN SOUTH AFRICAN SHAFT SYSTEMS

Latest developments in the expansion of South African shaft systems have been described by our correspondent in Johannesburg, who makes particular reference to the Klerksdorp district, and writes that new shaft headframes "are springing up like mushrooms" in that area. Examples may be cited of the Main Shaft at Zandpan, the No. 2 Shaft system at Vaal Reefs, and the Toni Shaft at Stilfontein, all concrete structures which "shoot up at high speed".

The Zandpan headframe, for example, is 187 ft. 6 in. high over a 26 ft. internal diameter concrete-lined shaft. Yet the whole headframe was erected in eighteen days by Concor Construction. A system of moving shuttering was used in this operation. Currently, the shaft is being



equipped for the start of full-scale sinking operations and the sinking hoists are being placed in position.

The Vaal Reefs shaft system consists of a 26 ft. dia. main shaft and a 20 ft. dia. ventilation shaft. These shafts will operate to a depth of 7,200 ft. in one lift. The 26 ft. shaft headgear will be 179 ft. high and on top of it will be the Koepe floor, so that when the winder is commissioned the final height will be 205 ft. This is only a few feet short of the West Driefontein No. 5 headframe, itself claimed as one of the tallest in the world. Internal dimensions at the base of the headframe will be 40 ft. by 40 ft. The ventilation shaft will be 99 ft. high.

The main 5,200 h.p. man-hoist in the Vaal Reefs system will move 100 men a trip at 3,000 ft. per min, while the 1,900 h.p. auxiliary man-hoist will accommodate 40 men a trip at 2,000 ft. per min. When the Koepe hoist is installed, it will handle 14 tons net of rock a haul from 7,200 ft. depth at 3,600 ft. per min.

When these impressive potential statistics are borne in mind, it is apparent that when shaft sinking proper commences on these properties there is likely to be fierce competition to establish a new world record, and particularly to pass the figure of 1,000 ft. in one month.

That this is by no means impossible is shown by the rate of advance being achieved at Western Deep Levels. The shafts on that property are going down through the notorious dolomites of the West Wits area, and until Western Deeps achieved momentum the highest rate of sinking completed in any month had been 300 ft. In September last year, the No. 3 main shaft was advanced 558 ft., and when it is considered that some 40 per cent of the available sinking time had been "wasted" owing to cementation operations, this figure becomes equal to 900 ft. in a straight run. Apart from the footage actually lost in delays, work was naturally slowed down through the lack of rhythm in sinking cycles, a most important factor in attaining a rapid rate of advance.

## EXPLORATION FOR NUCLEAR MINERALS IN CEYLON

Ceylon's Ministry of Industries will shortly take steps to provide the Department of Mineralogy with the additional equipment needed to expand and expedite the present programme of mineral exploration with a view to obtaining an accurate assessment of the country's raw material resources. The Department of Mineralogy has received two diamond drills under the American Aid Programme. The Minerals Exploration Project was initiated with this equipment in the middle of last year. The two drills will be used almost exclusively for the investigation of the subsurface iron ore deposits of the island for the next two to two and a half years.

Ceylon also possesses certain radioactive minerals. In order to carry out investigations into the occurrence of these minerals effectively, the department considers it essential to acquire two additional diamond drills with accessories. Besides the investigations into the occurrence of radioactive minerals, there are several other mineral deposits of economic importance which await further investigation by means of diamond drilling.

Radioactive minerals include large deposits of thorium-bearing minerals in the form of beach sands on the west and east coasts of the island. The Department of Mineralogy plans to carry out detailed surveys by scintillometers and also sampling of alluvial gravels in areas which have been proved to contain thorianite and urano-thorianite.

The first part of this investigation is expected to take two years and the second part about three years.

In view of the occurrence of atomic minerals in the island, the Atomic Energy Committee of the National Planning Council of Ceylon has recommended to the government that a Central Atomic Energy Authority for all purposes of nuclear development should be set up immediately.

## THE COAL INDUSTRY IN NEW SOUTH WALES

One of the important features of Australian mining in recent years has been the rehabilitation of the coal industry. This work has made slow but substantial progress and has now reached an important state of development. The coal mines can look forward to a new era of prosperity, the result of co-operation between the larger mining companies—the Broken Hill Proprietary Co. has been a leader—and the Joint Coal Board.

The progress in rehabilitation is well set out in the annual report of the Joint Coal Board for 1956-57. Consumption within New South Wales during the period reached a record of 12,190,000 tons, and there was a substantial increase in the tonnage exported overseas. While estimates of the future market indicate considerable increases in 1958 and subsequent years, there is a strong trend towards the development of special-purpose mines producing for specific customers, and expansion does not necessarily infer an expanding market for all existing mines. Coal still supplies 68 per cent of Australia's energy. In the ten year period to 1957, loss of coal fell from 10.8 per cent of possible production to 5.7 per cent; percentage of man-shifts lost to possible man-shifts underground fell from 10.55 to 3.93.

Power plants which will use low cost coal are now being built, or are to be built, at various parts of the coalfields and will ensure a steadily expanding market for the State's industry. There will be an increase in coal consumption accompanying the great expansion in the steel industry, which has a substantial future. There must be increased sales of coking and steaming coal provided economic prices are maintained. Nineteen washeries were in operation and six others were in course of erection during the year, while the average output per man-shift in all underground mines in 1956-57 was 3.71 tons compared with 3.45 in the previous year. Mines in which coal was all machine-loaded, with modern haulage facilities, produced 54.8 per cent of the State's coal, and their output per man-shift was 5.22 tons, with a selling price of 52s. 4d per ton; with all machine-loading but without modern haulage, accounting for 9.4 per cent, output per man-shift was 3.16 tons and selling price 64s. 8d. per ton. Highest output per man-shift and lowest selling price mines had fewer men on compensation.

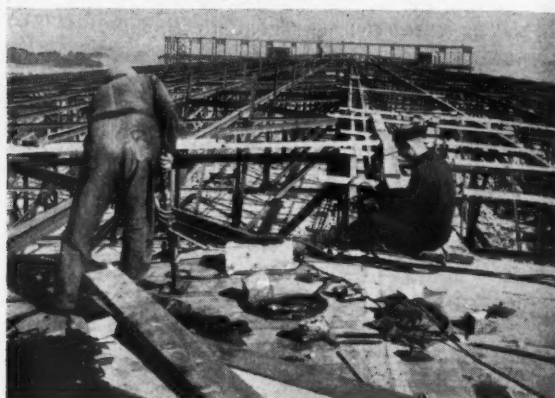
The proportion of total output of coal produced and handled with modern facilities is now in excess of 60 per cent. Coal won by continuous miners totalled 14.6 per cent; by coal-cutters, 58 per cent; hand mined, or grunched, 27.2 per cent. Coal loaded by continuous miners totalled 14.6 per cent; mobile loaders, 60 per cent; scraper loaders, 2.3 per cent; hand loaded, 22.9 per cent.

Coal production for 1959 is stated by the New South Wales Department of Mines to be 15,834,000 tons. The chairman of the Australian Coal Association announced that 80 per cent of coal in New South Wales is now produced mechanically, compared with 22 per cent in 1945. It is hoped to export about 1,000,000 tons of the year's production. Developments of the year will be covered by the Joint Coal Board's report for 1957-58.

# Baltic Ore Port Developments

Financed out of  
Nationalised Lapland  
Ore Fields Compensation

By JOHN GRINDROD



Workers assembling the steel skeleton of the 550-m. long rolling mill plant at Oxelösund, which will have an initial production capacity of 300,000 tons of rolled steel sheets annually

**C**LAIMED to be the largest single private investment scheme ever to have been undertaken in Sweden is the steelworks project at present under development at the Swedish east coast port of Oxelösund. It is being carried out by the Grängesberg-Oxelösund Company, and the combined investments in this scheme, other port developments, and a shipping expansion project, correspond almost exactly to the sum of 930,000,000 Swedish kr. (£64,000,000) receivable by the company from the Swedish Government for its previous shareholdings in the LKAB Lapland iron-ore mines which were nationalized a year ago.

Having, for many years, been shipping the iron ores from its Central-Swedish mines from Oxelösund, the Grängesberg-Oxelösund Company, in 1955, acquired the forty-year-old Oxelösunds Järnverk, which was a medium-sized plant for the production of coke and pig iron. In the same year a sponge-iron plant was added. Now under construction are a sintering plant, a blast furnace plant, a steel plant and rolling mills for steel plate, while the old coke oven plant is being extended. For this part of the Oxelösund development the estimated capital requirements are 550,000,000 to 600,000,000 Swedish kr. (£38,000,000 to £41,000,000).

Not only does the new project include the building of the furnaces and processing plants, but it entails vast new constructions for the storage and transportation of raw materials, as well as an extension and deepening of the port. It is estimated that the new plants will be in operation in 1960, about four years after the levelling of the building sites was started. By then, the town's present population of 6,500 is expected to have doubled and to reach the 20,000 mark in the 1970s. This, in turn, will give rise to large-scale housing construction plans and a considerable investment in public utilities.

## Plans for Expansion

The expansion scheme is planned to follow two lines of development. One will increase the capacity of the pig iron and coke plants, while the other will add a new phase to the processing programme, viz. the production of steel plate. For the former, a new smelting furnace is being installed beside the two existing furnaces. With a capacity of more than 1,000 tons/24 hours, this will be Sweden's largest. The capacity of the coke plant is being increased from 125,000 tons to 340,000 tons per annum, and a similar

expansion is foreseen for the plants for secondary products from the coke ovens. For the conversion of the pig iron into steel, the plant will have a capacity of 430,000 tons of ingots a year. These will be produced partly in rotating "Kaldo" converters and partly in an open-hearth furnace. The latter is to process circulation scrap from the rolling mills with an addition of 20 per cent pig iron. Fuel requirements will be met by coke-oven gas, tar, and oil.

Utilizing pure oxygen as a decarburizing medium, the new Swedish "Kaldo" method has the advantage of producing a particularly pure steel even when high-phosphorus ores are used as raw material. This is, therefore, of special interest to the Grängesberg Company, whose own deposits include large quantities of such ores. The method is the outcome of five years of research and experiment at the metallurgical institute of the Stora Kopparberg Company under the guidance of Professor Bo Kalling. It was presented in a paper to the assembled Swedish Iron Masters' Association in 1956, and has since proved to be a most economic method for producing mild steel of high quality.

From the steel plant the ingots will go to the rolling mills, an entirely new venture at Oxelösund.

Ore, coal, and limestone are to be stored in large areas close to the port and the railway shunting yards. A conveyor-belt system connects the various storage yards with the plants. One branch starts at the quay for the coal carriers and conveys coal through a tunnel below the shunting yards to two storage yards, which will each have an area of 82 x 350 m. (270 ft. x 1,155 ft.). The large ore storage yards and the coal yard are connected with a common double transport belt, which is carried in an overhead bridge system to the coke-oven and iron plants. The belt is to be walled in by corrugated aluminium cladding, for which 330,000 sq. ft. of sheet will be required. The aggregate length of the various conveyor belt sections is more than three miles. It has been designed and is being built by AB Nordströms Linbanor, Stockholm.

For loading and unloading raw materials between ships, storage yards, and conveyors, some interesting lifting machinery has been installed, including one unloading crane at the coal quay which is 53 m. (175 ft.) high, with a lifting capacity of 10 tons and a 98 m. (322 ft.) wide portal crane bridge, which spans the coal storage yard, and whose bucket lifts 20 tons. The entire transportation system is reported worth 30,000,000 Swedish kr. (£2,000,000).

#### Extensions at the Port

Extensions at the port, which is usually free of ice the year round and from which 1,500,000 tons of iron ore are shipped annually from ten quays with an aggregate length of three-quarters of a mile, include an eleventh quay and a new oil harbour. The new quay is now under construction and will have a water depth of 12 m. (40 ft.), i.e. deep enough to accommodate 30,000-ton vessels.

Except in the matter of coal, the Grängesberg-Oxelösund Company is practically self-supporting. It uses ores from its own deposits at Grängesberg and Strassa, the latter being a once-abandoned mine which has been recently re-opened and worked by modern methods. The ore is conveyed to the ironworks over the company's own electrified railway, TGOJ, one of the few remaining private railways in Sweden, and ore is shipped abroad and coal and oil imported by the company's fleet of some twenty-five modern motorships aggregating, at present, 300,000 tons d.w. The shipping enterprise is, in fact, one of the mainstays of the company's activities and is predominantly engaged in carrying ore from the now nationalized Lapland mines. A large fleet expansion is also under way.

## Germanium Rectifier Production

**A**FTER over 50 years of manufacture of high-power mercury arc rectifier equipment, the Hackbridge and Hewitt Electric Co. has now enlarged its facilities to include the supply of rectifiers employing semiconductor elements for low and medium voltage applications, and has in full production an extensive department for the complete manufacture, assembly, and testing of germanium diodes of the air-cooled and water-cooled types for use in Hewitt rectifiers.

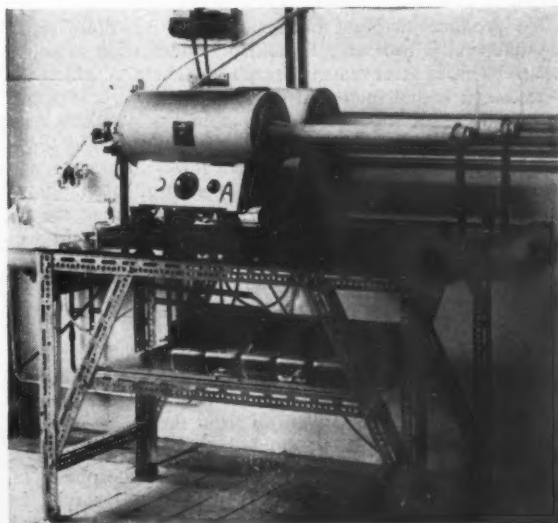
The company early recognized the possibilities of this new type of rectifier and as a result has been proceeding with research and development for several years.

#### Refining the Metal

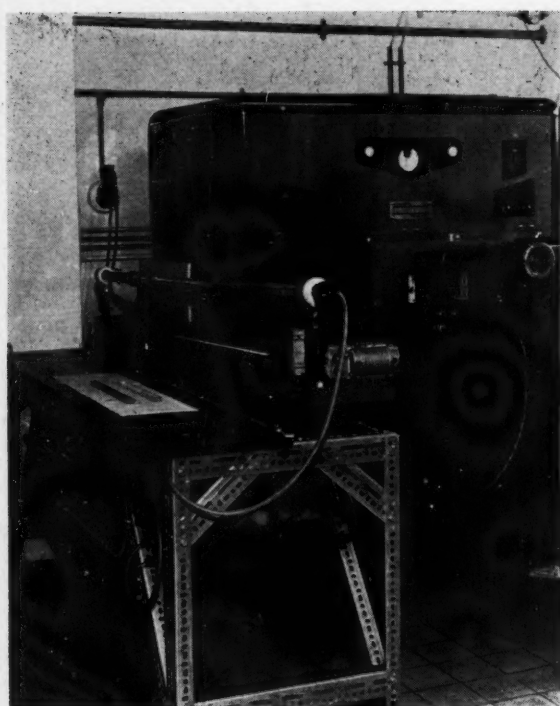
Since the correct working of the diode depends upon the presence of small amounts of known impurity elements it is necessary before these elements are added, to start with germanium which is extremely pure. To achieve this end the process known as zone refining is used.

An ingot of germanium and its containing crucible are placed under a hydrogen atmosphere in a long quartz tube. This tube is surrounded at intervals by three R.F. work coils which are arranged to travel together slowly from one end of the ingot to the other, so causing three molten zones about 1 in. wide to move along the bar in one operation. Any impurities present tend to remain in the liquid metal rather than move across the liquid/solid interface at the trailing end of the zone, and this results in them being swept to the end of the bar.

Twin furnace alloying bench







Apparatus for zone refining germanium ingots

The presence of impurities is detected by resistivity measurements made along the axis of the bar whereupon they can be removed by cutting off the end at a suitable point. These measurements are made at regularly spaced intervals on a line ground along the back of the ingot. The germanium is brought into contact with four independently sprung and accurately spaced probes situated in the instrument head. The outer probes pass a controlled current of 1 milliamp., and the resulting volt drop on the inner probes is measured by a sensitive reflecting type galvanometer directly calibrated in ohm cms.

#### Producing Single Crystal Metal

To produce an ingot of metal which is wholly single crystalline it is necessary to control solidification atom by atom. This is achieved in a special machine in which the germanium is first melted in a cup-shaped quartz crucible, by means of an R.F. work coil supplied at 400 kilocycles per second. A long thin piece of specially prepared single crystal germanium (the seed) is then lowered into the surface of the molten metal. Carefully controlled conditions permit the temperature to be high enough to melt the tip of the seed and low enough for a meniscus of liquid germanium to be held up from the molten metal by surface tension forces. The temperature loss through the chuck of the machine securing the seed causes the solid/liquid interface to move slowly down from the seed into the general mass, and when a sufficient diameter of solidification has formed around the tip of the seed, the seed is slowly and continuously raised. This results in a growing column of solid germanium being pulled up from the melt to be left hanging from the seed as a single large crystal.

The operation is carried out in an atmosphere of specially dried high-purity hydrogen, and this results in the formation of very clean and bright crystals. Seed

rotation and pulling are effected by constant voltage motors and the seed spindle and main plate are water cooled. Initial seed dipping is effected manually. The introduction of antimony to produce an N-type crystal is done during crystal growing by adding to the crucible a carefully calculated and weighed amount of this metal.

The completed crystal is shaped into a square sectioned stick and cut into 0.03 in. wafers by means of a small precision diamond saw of the type used for cutting diamonds. Both surfaces are then lapped to bring the thickness to 0.02 in. Every wafer used is centred on the crystal centre so that its isorhos are concentric. This gives the beneficial result of a symmetrical current density pattern.

Finally, the discs are cleaned and given the necessary surface finish by etching in acids, washing in running deionized water, and drying by infra-red heaters.

#### Making the Rectifying Junction

At this stage the rectifying junction is made. On one side of a disc of N-type single crystal germanium, a slightly smaller disc of indium is placed and the whole is brought up to a temperature greater than the melting point of indium (155 deg. C.) but less than the melting point of germanium (980 deg. C.). The germanium and indium wafers are loaded and jigged in graphite blocks in batches and alloyed inside quartz tubes under an atmosphere of hydrogen—as with zone refining and crystal pulling.

The electric furnaces surrounding the tubes are arranged so that they can be temperature stabilized before being moved along the tubes to the positions where alloying is to take place. This results in junctions of very regular characteristics, and simplifies the controls required.

The liquid indium quickly dissolves germanium up to saturation point, and upon cooling, the dissolved germanium precipitates out of solution and recrystallizes back on to the base germanium. This recrystallized layer of germanium now contains a larger number of indium atoms than it originally did of antimony atoms, and has now been converted to P type so that it forms a rectifying junction with the N-type base germanium.

#### Assembly of the Complete Diode

The rectifier junction has to be protected against contamination from all likely industrial atmospheres, and to this end it is hermetically sealed in a glazed ceramic tube which also serves as an insulator between the anode and cathode terminals.

Encapsulating of the junction in the heat sink is carried out on plastic-topped benches in an air-conditioned room in which a high standard of cleanliness is maintained. Before the final seal is made the diode is cleaned with specially filtered compressed air, and finally vacuum dried.

In the case of the air-cooled type, the diode is made as an integral whole, with the junction soldered directly on to the heat sink-cooling assembly—there are no separate cooling fins or attachments. By this means a low thermal resistance is assured and hot spots are avoided.

Electrical measurements and testing are carried out in a specially equipped test room, where routine tests of reverse and forward characteristics are made for the purpose of grading each diode. This is followed in every case by a load test in a single phase, half-wave, resistance load circuit, during which the diode is tested according to its grading. In addition, by means of a special circuit, its on-load reverse current is observed and recorded. Each diode receives a serial number and its characteristics are registered for future reference.

# The Mineral Industry of South-Eastern Alaska

**S**OUTH-EASTERN ALASKA is a narrow coastal strip of rugged mountains and many islands. The climate is mild, with an average annual temperature of 40° and heavy rainfall. Geologically, the region is favourable for deposition of ore; geographically, it is difficult to prospect and to develop, except along areas immediately adjacent to the coastline. The mineral industry of the region is described in *Information Circular 7844*, published by the U.S. Bureau of Mines.

Environmental conditions that affect the development of an industry to exploit South-Eastern Alaska's minerals are generally favourable. An adequate labour supply can be developed, but will be expensive because of the high cost of living. Only high-grade ores (State standards) and concentrates can be economically transported to market by present services, but costs may be reduced by larger back-hauls or the use of barges and tugs. The water supply is ample for most purposes. In many places waterpower may be developed. Taxes are no higher than those in many areas of the United States.

Development of the North-Western United States has resulted in increased possible markets for South-Eastern Alaska ores, particularly iron and uranium. Several base-metal smelters are at tidewater or relatively close to ports on the Pacific coast. Direct ocean shipment of ore to Japan also may offer an outlet, as it is within economic shipping distance of Alaska.

The South-Eastern Alaska region is a 40,000 square mile area between parallels (latitude) 54 deg. 30 min. to 60 deg. 30 min. and meridians (longitude) 130 deg. to 141 deg. The region extends from the St. Elias Mountains on the north to Dixon Entrance on the south; it is bordered on the north by the Yukon Territory and British Columbia; and on the south and east by British Columbia; the Pacific Ocean is the western boundary. The annual average temperature in South-Eastern Alaska is comparable with that of the Northern United States; the climate is characterized by heavy precipitation and moderate temperatures throughout the year. Rainfall, as measured at Juneau over an 11-year period, occurs on an average of 224 days per year. Snowfall is heavy in the mountains and inland areas.

South-Eastern Alaska is essentially a mountainous northern jungle with thick forests on the lower mountain slopes and in the larger valleys. A substantial part of the region, is covered by scrub timber, brush, grass, muskeg, and loose rock. In most areas the undergrowth is so dense it conceals the underlying rock. This results in difficult and expensive prospecting. The region may properly be considered to consist of the main-

land and the Alexander Archipelago. The latter, embracing more than 1,000 islands, comprises at least one-third of the land surface of South-Eastern Alaska. The dominating structural feature of the South-Eastern Alaska mainland is the Coast Range.

The oldest rocks of the region are Paleozoic. They consist primarily of metamorphosed limestone, schists, cherts, and greenstones, overlain by metamorphosed conglomerates, sandstones, and shales of the Mesozoic and Cenozoic (Tertiary) eras. The Paleozoic strata are intruded by coarse granular igneous rocks with composition from granodiorite to quartz diorite to hornblende diorite to pyroxenite and dunite.

## Mining History and Production

The mining history of South-Eastern Alaska illustrates the potential wealth of the region. In 50 years (1906-1956) the lode mines of the area yielded 6,200,000 ounces of gold, 3,300,000 ounces of silver, 37,000,000 pounds of copper, 48,300,000 million pounds of lead, 111,000 pounds of zinc, and 14,000 ounces of platinum-group metals, principally palladium. This output represents, at 1955 prices, approximately \$250,000,000 in metals.

In 1955 minerals valued at \$230,000 were produced in South-Eastern Alaska. \$66,000 represented the gold, silver, and lead output from a mill clean-up, and the remaining \$164,000 sand and gravel, stone and gem stones. The mineral industry declined some years ago owing to exhaustion of early bonanzas and a drop in the purchasing value of gold. Activity has been low for the past fourteen years, and interest in the mineral resources of the region has only just begun to revive. Stibnite is found in a fissure vein and as disseminations in limestone at Camaano Point at the south end of Cleveland Peninsula.

Native antimony constitutes a substantial part of the metal content of a gold quartz vein at Sunset Cove on the mainland south-east of Juneau. Small fissure veins containing barite occur in limestone, conglomerate, and volcanic rock along the north side of Cornwallis Bay and the south side of Saginaw Bay (both on Kuiu Island), and at the north-east end of St. Ignace Island near Ketchikan. Barite replacement deposits in limestone occur on the Castle Islands, Kupreanof Island, and at Lime Point on Prince of Wales Island.

Most of the known copper deposits of South-Eastern Alaska are in the Ketchikan area, many of them are lenticular or irregular deposits in limestone adjacent to contacts with igneous intrusives. Others are in wide shear zones in green-

Selected Mineral occurrences in South-Eastern Alaska





stone or schist. Garnet is found in this region as massive aggregates in contact-metamorphic deposits, and as disseminated crystals in rock. Garnet in a crystalline schist has been mined  $7\frac{1}{2}$  miles north of Wrangell. Other occurrences have been reported at Port Houghton and Copper Mountain.

Gold has been the principal mineral product of the region. It occurs in quartz veins, in sulphide impregnation zones, in dikes, and in lodes that are composed of quartz, stringer zones in sheared slate. Gypsum occurs at a few places in this region. It has been mined successfully at Iyoukeen Cove, on the east side of Chichagof Island. It is possible that gypsum occurs elsewhere in similar deposits. Iron-orebodies in South-Eastern Alaska occur principally in association with contact-metamorphic copper deposits and as dissemination or nearly massive segregations in basic rocks such as pyroxenite and hornblendite. Despite the relatively small historic output of lead and zinc from the region's mines, mainly as a by-product of gold production, known occurrences of these metals in the form of the minerals galena and sphalerite are widespread.

South-Eastern Alaska area contains numerous deposits of high-grade limestones, many of which appear to be suitable for chemical-grade material. The most promising of these are on Dall, Heceta, Kuiu, Kupreanof, Long, Prince of Wales, Shrubby, and Wadleigh Islands. Molybdenum prospects have been found on Lemesurier Island in Icy Strait, at Shakan, at the north end of Noyes Island on the north side of Adams Inlet, on the Chickamin River, and near the head of Muir Inlet. It occurs disseminated in contact-metamorphic deposits, in pegmatitic quartz veins, in quartz fissure veins, in aplite and pegmatite veins, and as fracture facings.

Nickel-copper deposits have been found on Yakobi Island, Fleming and Chichagof Islands, Admiralty Island, and Snipe Bay (Baranof Island). These consist mainly of pyrrhotite with some pentlandite and chalcopyrite in genetic connection with gabbroic or noritic intrusive masses or dikes. It appears highly probably that there are other nickel deposits in the region. Ilmenite occurs in segregations and in association with magnetite in the ultra-basic intrusives, and has been reported as a constituent of some of the beach sands in the region.

Small scheelite orebodies have been found at the Apex-El-Nido mine on Chichagof Island, and at the Mountain View and Riverside properties in the Hyder district. Tungsten-bearing minerals have been found at many other places in South-Eastern Alaska. Radioactivity has been reported from several areas but commercial exploitation has been announced only for uranium from Bokan Mountain, near Kendrick Bay, Prince of Wales Island. This area was discovered by airborne survey, but very little detailed ground prospecting has been done.

#### Elements in Development

No experienced mine labour exists in South-Eastern Alaska, because no mines have been operated since early in World War II. However, during the active period (1890 to 1943) a good indigenous supply was developed.

The region is fortunate in having been endowed by nature with an inland water route extending from Puget Sound on the south to Skagway on the north. This "Inside Passage", a series of deep water channels and straits, provides easy access to tidewater for every part of the region. The steamship method of transport could be used to ship ore or concentrate to market. The ton-mile cost of transporting ore from South-Eastern Alaska to Seattle-Tacoma via scheduled service is estimated to be 11.2 mills, based on a 1,000 mile haul at 56 cents per 100 pounds. An alternate method of

hauling ore from the mines of the district to the Seattle-Tacoma area, as well as equipment and supplies north to the mine, would be by chartered tug and barge.

No scheduled commercial air-freight lines operate between the United States and South-Eastern Alaska. The regular, scheduled passenger flights from Seattle to Annette Island and Juneau however, do carry some freight. Despite the lack of air-freight service from Seattle, the availability of large bodies of water has led to development of an excellent seaplane transportation network in the region. The helicopter, is being advanced rapidly as a means of transporting exploration parties and supplies in areas where airplane-landing facilities are not available.

Highway travel from one part to any other part is impossible because the rugged terrain and the predominance of swampland in level areas have prevented highway construction.

#### Power

Hydropower is one of the major potential resources of South-Eastern Alaska. A large number of possible power sites (many small ones), might be utilized by mining or metallurgical operations. Producing large blocks of power would be a major incentive to the development of such mineral industries as aluminium and magnesium reduction and electric smelting of iron, copper, and zinc ores. The three largest potential sources of waterpower in the region are the Taiya project and the Taku and Stikine Rivers.

Despite the huge power potential available from the streams and rivers of South-Eastern Alaska, most new mining operations will find it more expedient to utilize diesel equipment for their power needs than to invest substantial sums for erecting dams, penstocks, turbines, generators, transmission lines, etc.

#### Markets

The major deterrents to development of a mineral industry in South-Eastern Alaska have been the difficulties of access and transportation (except along protected shore-lines, the lack of purchasers within economic shipping distance, and (to some extent) mineral-dressing difficulties caused by the complexity or low grade of some ores.

Copper and lead ore and concentrate have been shipped to the American Smelting and Refining Co. copper smelter at Tacoma, Washington, and to the company lead smelter at Selby, California. These two plants are located at tide-water and provide a market within easy shipping distance. One of the most promising mineral resources is iron. The growing need for steel on the west coast of the United States could provide an outlet for iron ores and concentrate. There are iron blast furnaces at Fontana, California, Pueblo, Colorado, Geneva, and Ironton, Utah; these apparently are well supplied with ore from Utah, Wyoming, and California. A possibility remains, however, that the companies would be interested in a supplemental supply.

The seller of uranium ore must be licensed by the Atomic Energy Commission (AEC), and must sell his material to a licensed AEC buyer at a price determined by the Commission. South-Eastern Alaska ores probably would be sent to the newly constructed plant of the Dawn Mining Co. at Ford, Stevens County, Washington.

Other metal resources of the region comprise antimony, nickel, and tungsten. Under present conditions, it is doubtful if antimony ore produced in South-Eastern Alaska could compete with low-cost foreign material. However, shipments of antimony ore have been made from other parts of the territory in the past few years, for use as a pigment.



## Machinery and Equipment

### Scotland's Expanding Safety Industry

On Wednesday last week Mine Safety Appliances Ltd. opened a display of their equipments with a preview for the Press. The exhibition is currently being held in the Scottish Council's London Centre.

The display includes all the items at present under manufacture in addition to samples of the items scheduled for manufacture within the coming months. These items range from carbon monoxide testers to specially-developed items for the nuclear industry, and include portable oxygen indicators, infra-red analysers, eye protectors and respirators. In addition there are other safety appliances which are becoming increasingly necessary to counter the hazards of the complex industrial and mining operations of today.

Of particular interest was the Toxic Gas Detector, an instrument capable of measuring a concentration of 100 p.p.m. Benzene in air and 400 p.p.m. for Toluene and Xylene, and giving an accurate reading in less than one minute; and the Lamb Air Mover, a practical and portable ventilating device used either as blower or exhaustor, which converts the pressure of a compressed air line into a large induced volume of moving air.

The display represents the results of efforts made over the last eleven years by American and Scottish engineers to keep ahead of the safety requirements of every branch of industry. Safety problems are international and many of the items on display, which were developed to meet the requirements of United States companies, are now saving lives or protecting equipment in British, Continental and Commonwealth countries.

The Mine Safety Appliances Co., the first American-owned company located

in Scotland to have taken advantage of the Council's London facilities, has a programme of development which will lead to the eventual production in Scotland of almost all of the 3,600 products produced by the parent company in Pittsburgh, Pennsylvania. This will give them the most varied assembly line in Britain, particularly as the items concerned are generally highly specialized items produced individually or in "short run" quantities.

It is significant that the claim is made that in over 5,000,000 man hours worked in M.S.A. plants throughout the world no hours at all have been lost due to accidents.

#### CANOPY FOR SETTING ARCHES

The National Coal Board's Central Engineering Establishment has been engaged for some time on the development of canopies for arch-setting work in new headings. One promising design is a cantilever canopy for use with three-piece arches in 16 ft. by 12 ft. roadways, which can be used in conjunction with any set of equipment which will leave sufficient headroom for its operations.

As can be seen, the canopy, which is self-advancing, is mounted at roof level beneath the arches already set. To do this, hanging brackets containing guide rollers are clamped to the arches as they are set, and R.S.J. rails integral with the canopy mounting are supported by the rollers and ride forward on them when the canopy is to be advanced. Hydraulic or pneumatic cylinders can be provided to impart this forward movement; alternatively, the mounting can be winched forward.

The canopy itself is of corrugated sheeting carried on transverse segments

which are in turn supported on a framework of tubular steel. This framework projects as a cantilever beyond the last arch, and is hinged so that the canopy can be canted downwards when required. The canopy is held in the operating position by two hydraulic cylinders; these cylinders can be set to yield at a predetermined load, so that when this load is reached the canopy will tilt forwards and shed debris away from personnel and equipment.

When an arch is to be set, the canopy is lowered to an angle of 30 deg. to the horizontal, and the arch is inserted in slots provided for this purpose in the canopy. The canopy is built in sections of 3 ft. each to cover advances of 6, 9, or 12 ft.

Another design under consideration at the Establishment involves a canopy which, instead of being hinged, can be raised and lowered as required by means of a roller chain in vertical steel channels. This canopy also projects as a cantilever beyond the last arch set, but when it is to be used as an arch setter two channels are lowered at the support end of the canopy to act as guides down which the canopy is lowered to ground level. This canopy is in sections to take two, three, or four arches, and advances of up to 12 ft. The canopy and arches are raised by hoisting gear powered by a 7 h.p. electric motor. As with the hinged canopy, this device is mounted on brackets slung at roof level beneath the arches already fixed. This canopy also can be made to yield at a predetermined load.

#### NEW TUNNELLING ACHIEVEMENT

In the course of a contract recently completed for the National Coal Board, the Cementation Co. Ltd. is believed to have established a new British colliery record for driving a tunnel at a gradient of 1 in 4. The contract involved the driving of a 14 ft. dia. tunnel through typical coal measures for a total distance of 1,821 yds. at the N.C.B.'s new combined colliery at Hafodrynys, near Pontypool, Monmouthshire.

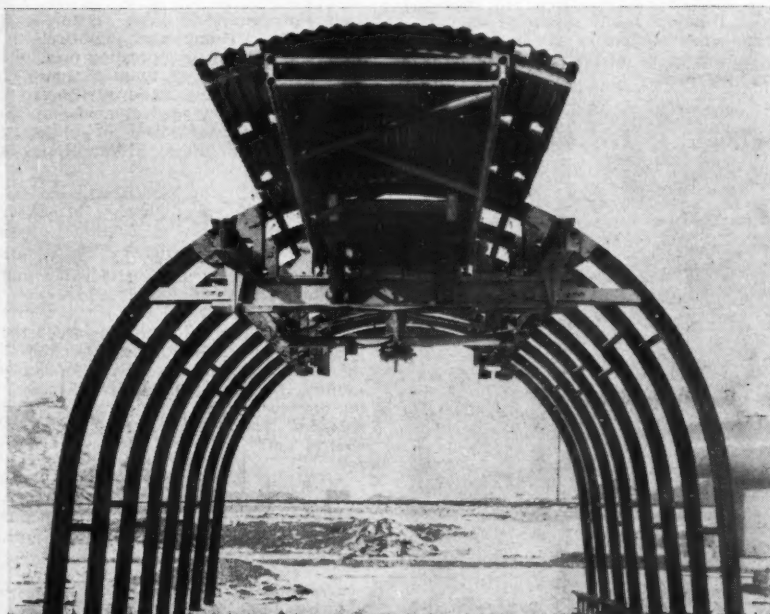
The tunnel was driven at a dipping gradient of 1 in 4, except for the last 50 yds., where the gradient was 1 in 20. It was completed under these conditions in a net working time of 66 weeks. Operations were carried out continuously by a total of 36 men, working 18 eight-hour shifts (144 hours per week) in three teams of 12. Each team comprised six men at the tunnel face, and six on haulage and general duties.

The average speed of tunnelling was 27.6 yds. per week, although in several instances the actual weekly rate was more than 40 yds. The best weekly advance totalled 56 yds. Equipment used in the tunnelling operation included Atlas Copco drilling machines, Eimco model 21 loading machines, and 60 cu. ft. capacity Hudson Granby cars.

#### TRAVELLING GRANITE CRUSHER

A 137-ton gyratory granite crusher was recently conveyed by British Road Services Continental transport ferry service from the French manufacturers at Montbrison to its destination at Bardon Hills Quarries, Leicester. This giant load was the heaviest single consignment ever carried on the ferries.

Cantilever canopy for setting arches



# MINING

## MISCELLANY

The production of manganese ore in India during 1958 has been estimated at 1,230,000 tonnes (1,211,000 l.tons) by the Indian Bureau of Mines. Orissa State remained the leading producer of manganese ore during the year with an output of 360,000 tonnes (355,000 l.tons), followed by Bombay State with 311,000 tonnes (306,000 l.tons), Madhya Pradesh 283,000 tonnes (279,000 l.tons), and Mysore 240,000 tonnes (236,000 l.tons).

Work on the giant Belgian Congo hydroelectric scheme at Inga will not now begin before the end of 1960. A committee appointed to draw up a timetable for the scheme has stated that the first stage of construction of the first power plant will take five years. The Inga project is for the construction of a series of dams and power stations to provide a total power of some 25,000,000 kW. when complete. The first stage of construction envisages a power output of some 1,500,000 kW. The project contemplates the creation of an "African Ruhr", thanks to the bauxite deposits which have been found nearby. Aluminium and other electro-chemical industries are planned for the area.

Companies of Japan's Mitsubishi Group announced at the inaugural meeting of the Ore Transportation Co. they had jointly formed, that they will set up a Chile Metal Mining Co. for the exploitation of iron ore mines at Las Adrianitas, in Atacama State, Chile. The capital is to be 250,000,000 pesos

(Y.100,000,000) and approval has already been given for investment of the first tenth of that sum. Plans include the construction of a 35-mile road from the mines to a harbour, yet to be constructed, and the building of two 35,000 d.w.t. ore carriers. The mines are expected to have an annual output of 300,000 tons and reserves of over 10,000,000 tons.

The State Trading Corporation of India is exploring the possibilities of exporting iron ore through Mangalore port to Italy, West Germany, and the United Kingdom. The first consignment of iron ore from Cochin has already been dispatched by the State Trading Corporation to Czechoslovakia. This amounted to 4,500 tons. It is stated that Czechoslovakia has agreed to purchase 1,000,000 tons of iron ore from India, costing Rs.55,000,000. Czechoslovakia will thus be one of the biggest importers of Indian iron ore.

Preliminary preparations for the establishment of a 250,000 kW. atomic power station in India will be undertaken in the next financial year. A provision of Rs.1,600,000 has been made. The project is estimated to cost Rs.450,000,000. The Atomic Energy Commission of India, after a careful study of the economics of nuclear power in the country, has recommended the installation of 1,000,000 kW. of nuclear power by the end of the third five-year plan period. The Commission proposes to set up a uranium mill in Bihar to process about 500 tons

of uranium per day, with provision for expansion to treat double the quantity. Estimated to cost about Rs.20,000,000, the plant will be completed in about three years.

The Alton, Illinois, lead smelter of American Smelting and Refining Co., will close down in July, after more than fifty years of continuous operation. Announcement of the closing was made in New York by Mr. J. D. Mackenzie, Asarco's board chairman and president, who said that the notice of termination of the smelting contract between St. Joseph Lead and American Smelting and Refining had made the step imperative.

An aluminium electrolysis plant in Stalingrad, U.S.S.R., which, when finished, will be the largest and most important in the whole Soviet Union, has come into part operation.

Perak, at present the leading tin-producing State in the Federation of Malaya, is now to become a major producer of iron ore, according to a statement by a spokesman of the Ipoh Mining Co. Ltd. He estimates iron ore reserves in the State at 5,000,000 tons. At present, three companies are operating iron ore mines in Perak, with a combined annual output of some 500,000 tons. Last year, overseas exports totalled 200,000 tons. The Ipoh Mining Co. Ltd. has completed an agreement with a group of Japanese steel mills to ship 170,000 tons of iron ore to Japan in the year commencing April 1, 1959. It is also announced that eight Japanese mills will between them take 570,000 tons of iron ore from Perak alone during the same period.

A special showing of two new Mobil Oil Co. films was given at the British Council cinema on Wednesday this week in London. The films were entitled "Lubricants with Care" and "Compressor Lubrication", and the sixth and seventh to appear in a series of industrial films being made by the European group of Mobil Associates. "Lubricants with Care" deals with the manufacture, transportation, storage, application, and reclamation of high-grade lubricants. It was made by Mobil Oil Française and won a medal at the 1958 Cannes Journées Européennes du Film Technique et Industriel. "Compressor Lubrication" has as its subject the operating principles and lubrication of all types of compressors. This film was made by Mobil Oil Italiana, and won a silver medal at the Second National Festival of Industrial Documentary Films at Monza, Italy, in June, 1958.

### PERSONAL

Mr. L. Goldschlager has been appointed a director of Nigel Finance and Investment Ltd.

An international jury has awarded the gold medal in the Engineering Section of the eighth International Inventors' Exhibition to Mr. I. M. Furnivall, managing director of I.G.E. (Automation Division) Ltd., for his Masterotor automation control unit.

Mr. L. B. Berger, of Pittsburgh, Pennsylvania, United States, has been appointed to head the Division of Health in the Bureau of Mines, United States Department of the Interior.

Mr. Noel M. Kenny, general manager, Roan Antelope Copper Mines Ltd., has

First of its kind to be built in Europe, a 400-ton diesel electric floating crane is now being towed 4,700 miles to the Lake Maracaibo Oilfields. Called the "Atlas", the unit will speed up oil operations considerably since it will transport a complete drilling floor and derrick, including derrick floor, all floor equipment and drill pipe racked in the derrick, from one foundation to another. The rigging up and down of the derrick and other equipment will no longer be necessary. The applications might be considered as interesting in relation to off-shore mining operations





been appointed chairman of the employers' panel of the Mining Joint Industrial Council. Members of this panel will be the general managers of Bancroft Mines Ltd., Mufulira Copper Mines Ltd., Nchanga Consolidated Copper Mines Ltd., Rhokana Corporation Ltd., Roan Antelope Copper Mines Ltd., and the manager of Chibuluma Mines Ltd. It will be recalled that the recommendations of Sir Frederick Leggett to keep the Copperbelt free from strikes were the subject of discussion in our issue of April 10.

Mr. Walter Wehtje has retired from the board of directors of Atlas Copco. His successor as chairman of the company is Mr. Marcus Wallenberg.

Mr. L. J. Cox, M.I.P.R., has been appointed chief of the Press Relations Department of Wolf Electric Tools Ltd.

#### AGENCY WANTED

Messrs. Shrivax C. Cambata and Co. (Private) Ltd., of 42 Queen's Road, Bombay 1, are interested in obtaining United Kingdom agencies for mining equipment, earth-moving equipment, locomotives, etc., and steel. They are particularly interested in tungsten carbide tips and tools, conveyors and earth-moving equipment, heavy transformers, springs, and spring steel. The colliery department of the firm own and operate the Rakhikol collieries in Madhya Pradesh, which have a yearly production of 100,000 tons. The company also operate the Naitra manganese mines at Balaghat.

Suppliers interested in this agency inquiry should write direct to the Bombay concern. It would be appreciated if at the same time they would notify the United Kingdom Trade Commissioner, P.O. Box 815, Mercantile Bank Building, Mahatma Gandhi Road, Bombay No. 1, that they have done so. Ref. ESB/3291/59. Telephone inquiries to Chancery 4411, extension 776 or 866.

#### CONTRACTS AND TENDERS

Contracts worth nearly £4,500,000 have been awarded to the Mitchell Construction Co. Ltd., of Peterborough, by the North of Scotland Hydro-electric Board. They are for the Board's Strathfarrar/Kilmorack Hydro-electric Scheme near Beauly, in Inverness-shire. The work involves the construction of the Deanie Tunnel, the Monar Dam, and the Culligan tunnel and power station.

A contract for supply, delivery, and erection of a skip-winding plant at Lady Windsor Colliery, in the Rhondda Valley some 20 miles north of Cardiff, has been awarded by the National Coal Board to Humphreys and Glasgow Ltd., of London.

An order valued at about £100,000 has been placed with the General Electric Co. Ltd. by the North-Eastern Division of the National Coal Board for one 400 h.p. and one 1,000 h.p. a.c. winder for Elsecar Colliery. The mechanical parts will be built by Fullerton, Hodgart and Barclay Ltd. G.E.C. has received also a £1,250,000 order for a complete ore-preparation plant for Richard Thomas and Baldwin's new Redbourn works. The value of recent orders for winders placed by the National Coal Board with The General Electric Co. Ltd. now totals nearly £400,000.

### Metals and Minerals

## Proposed Quotas For U.S. Fluorspar Imports

The Senate Interior Minerals subcommittee has started hearings on a Bill which seeks to "revitalize" the United States domestic fluorspar industry by placing flexible quotas on domestic production and imports, based on a plan similar to the long-standing Sugar Act. This measure, which is in the nature of a trial balloon for establishing a domestic policy on other minerals, is endorsed by the chairman of the Senate Interior Minerals subcommittee, Senator James E. Murray, and other Senators. It is expected to be approved by the Interior Committee this spring and to be favourably received by the Senate.

Fluorspar has become increasingly important in recent years because of its use in the production of steel, aluminium, hydrofluoric acid, fluorine gas, and atomic energy. Fluorine is an ingredient of fuels used for missiles and rockets.

Statistics released by the Bureau of Mines, United States Department of the Interior, show that domestic production of finished fluorspar in 1958 totalled 339,000 s.tons compared with 322,600 s.tons in 1957 and 268,400 tons in 1955. Imports for consumption were reported to have totalled 392,000 tons last year, the chief suppliers being Mexico, Italy, Spain, and Germany. Consumption at about 494,100 tons was 23 per cent lower than in 1957.

United States domestic producers of fluorspar have derived some assistance in recent years from government purchases for the stockpile programme. Foreign producers have been encouraged through loans and grants, and have also been participating in sales for the United States stockpile, as well as shipping fluorspar under barter contracts.

Government purchases of acid-grade fluorspar under Public Law 733 were terminated at the end of 1958. Stockpile purchases of metallurgical grade fluorspar were stopped on June 30.

In October, 1958, the Independent Domestic Fluorspar Producers' Association filed with the Office of Civil and Defence Mobilization (ODM) an application under Section 8 of the Trade Agreements Act of 1958 for an investigation to determine if fluorspar imports threatened to impair the national security.

The present Bill seeks to divide the consumption of fluorspar by United States industry between domestic and foreign producers, maintain a stable price for users, and permit the barter of domestic farm products for fluorspar. Foreign producers would be given approximately three-quarters of the rapidly increasing consumption, so that within two or three years they would be supplying between 60 and 75 per cent of the domestic market. Domestic producers would be permitted to supply 200,000 tons of the domestic consumption containing more than 97 per cent calcium fluoride.

Each year, foreign producers would have their share of the fluorspar market increased by receiving 75 per cent of the

increase in consumption until imports had reached the average for the years 1956, 1957, and 1958. Thereafter, they would receive 60 per cent of the increasing consumption.

The Bill would also permit domestic producers to furnish 125,000 tons of the consumption requirements of fluorspar containing not more than 97 per cent calcium fluoride, with foreign producers supplying the balance.

These proposals have been strongly opposed at the hearings by spokesmen for the Interior, Commerce, and State Departments, who contended that its provisions were "not only contrary to established national policy, but also not feasible from a practical point of view". It may also be expected to run into stiff opposition during its progress through the House. Its reception will be a pointer to the prospects for other Bills intended to assist the United States minerals industry, notably that sponsored by fifteen Western Senators, which would require the Secretary of Commerce to establish and administer a system of import quotas on lead and zinc aimed at maintaining the domestic prices of common lead and slab zinc at 15½ c. and 13½ c. respectively.

#### QUICKSILVER UP AGAIN

The London ex-warehouse quicksilver price is now indicated at £79 per flask—a further rise of £1. At the moment, supplies on the spot are reported to be extremely tight, but it is said that arrivals can be expected in the near future of quicksilver believed to be of Mexican, Chilean, Peruvian, and Turkish origin, part of which is unsold. It remains to be seen whether these arrivals will check the current upward tendency in London spot prices.

The rise in quicksilver prices also continues in the United States, the current quotation being \$237 to \$240 per flask.

#### U.S. WOLFRAM PURCHASES

The only item of outstanding interest in the United Kingdom wolfram market, which otherwise remains generally quiet, is a big purchase by the United States which has taken up a quite considerable part of the unsold stocks still available in Europe.

Estimates of the amount so far involved range from 150 to 200 tons, and it is considered possible that this quantity will be increased since inquiries from the United States are said to be continuing. Some dealers think that this buying has latterly helped to sustain the c.i.f. European price at from 84s. to 89s. per 1 ton unit at a time when the undertone of the market was regarded as none too assured.

The view has been put forward that the United States buying could be for replenishment of stocks against a possible pick-up in demand. General production of wolfram ore in the United



States ceased some time ago, following the withdrawal of government support, and only two mines are now operating.

Business with the United States has been at the equivalent of about 86s. per ton, and so far it has been possible for these sales to be partly replaced at prices below this figure. It remains to be seen how long this situation can continue, assuming that United States buying persists, before European stocks are run down or producers raise their selling prices.

#### INCO REFINERY AT THOMPSON

International Nickel are to start immediately the building of a nickel refinery costing \$20,000,000 to \$25,000,000 at Thompson, Manitoba. The refinery, which will have an annual capacity of up to 37,500 s.tons of nickel, is expected to start up next year, reaching full production in 1961. It will employ a new process developed by Inco research and one of the by-products will be impure sulphur which could be refined for the pulp industry. It is understood that this development will in no way affect Inco-Mond's refining operations in Britain.

#### IMPORTANT CAESIUM FIND

The TC Mining Co., of West Paris, Maine, claims to have discovered what may be one of the Western World's largest deposits of very high-grade caesium ore in the State of Maine. The company estimates that the deposit might contain several thousand tons of ore which is believed to be up to 42 per cent pure caesium. The market value of the pure metal is currently in excess of \$4 a gramme.

One of the largest known deposits of caesium is the pollucite (aluminium-caesium silicate) occurrence in the spodumene deposits of Montargy Explorations at the Bernic Lake property in Manitoba. Work by Montargy and the American Metal Co. (now American Metal Climax) outlined the extent of the spodumene deposit and indicated that interesting amounts of pollucite, lepidolite, amblygonite, and beryl were present. Drilling has indicated over 9,000,000 tons, averaging 2.14 per cent lithium oxide. The commercial grade caesium pocket is estimated at 150,000 to 200,000 tons.

Caesium, a very light metal with the very low melting point of 28½ deg. C., is used both in atomic energy and in the manufacture of guided weapons. It is also chemically highly reactive and can be a most efficient catalyst. It is regarded as potentially an important catalyst in the manufacture of advanced types of guided weapon solid fuels. In atomic energy, naturally occurring caesium can be converted into radioactive caesium by irradiation in a nuclear reactor and can then be used as a source of radioactive gamma rays for industrial and medical use. Most of the supplies of radioactive caesium, however, are obtained as a by-product of burning uranium in reactors.

According to Robert W. Pidd, University of Michigan Professor of Physics, a new method has been discovered for converting atomic energy directly into electric energy. It is based on the old thermocouple process using two different metals—cooling one and heating the other to produce an electric current. The new process uses ionized caesium vapour (plasma) as one of the metals.

Late last year, it was reported that work was in progress on an ionic engine for space travel using caesium vapour and an electromagnetic field.

## COPPER • TIN • LEAD • ZINC

(From Our London Metal Exchange Correspondent)

The market has seen increased activity in copper dealings with an appreciable reduction in the price taking place, whilst for the other three metals interest remains small and price changes negligible.

#### RECEDING STRIKE PROSPECTS DEPRESS COPPER

After the recent buying in anticipation of a strike at the end of June in America, consumers became less interested towards the middle of last week. This resulted in pressure on the commodity markets in London and New York, and the inability of United States customs smelters to maintain their price of 34 c. per lb., this price being lowered by 1 c. per lb. at the end of last week and a further 1 c. at the beginning of this week. At the new figure of 32 c. per lb., it is only ½ c. per lb. above the producers' price. Their intake price for scrap was reduced accordingly and now stands at 26 c. per lb. Consumer interest started to revive and markets developed a steadier appearance by mid-week.

The figures issued by the Copper Institute (all in s.tons) for March production and consumption then became available, and they show that in the United States production of recent refined copper was slightly lower at 140,928 tons against 142,235 tons in February; deliveries to consumers were higher at 124,220 tons against 120,134 tons in February, but in spite of this stocks only fell to 82,952 tons from 85,523 tons. Outside America, production showed an increase at 144,497 tons against 121,783 tons; deliveries were appreciably better at 146,605 tons against 123,607 tons, but in spite of this stocks rose to 236,232 tons from 218,780, and these figures were a further unsettling influence.

The turnover in London has been heavier than for some time past, with steady selling being well absorbed at the lower levels. There is now talk that perhaps the Bull market, which started at the end of February, 1958, is now coming to an end, and this may well be the case if the strike position in America appears to be less serious than was at one time thought. At the time of writing, the only copper strike is in Tacoma, as those threatened in Montana and Canada did not materialize. This has given additional food for thought with regard to the mid-year position.

Stocks in official warehouses showed a small increase of 100 tons at 9,741 tons and the level quotations for cash and forward metal have been maintained. Opinion is more divided than for some time in the past, and the crux of the matter appears to be whether the consumers will re-enter the market at these lower levels or whether the buying of recent weeks will enable them to stand aloof for a further period. Consumption itself remains at a reasonable level, with slight indications that it may be on the upgrade again in Europe and the U.S.

#### TIN LITTLE CHANGED

The tin market has remained featureless, with consumer demand spasmodic and with the buffer stock manager apparently remaining out of the market. Stocks show a further decline of 553 tons, bringing the total down to 9,626.

On Thursday morning, the Eastern price was equivalent to £809½ per ton c.i.f. Europe.

#### WAITING FOR WHAT?

The lead and zinc markets have remained without sign of life and the clamour in America is growing louder for some additional action to be taken to boost up prices in that country. One party is calling for more stringent quotas, whilst others, including the president of St. Joseph Lead Co., are advocating that whilst the lead and zinc prices are below a certain figure, increased tariffs are the only solution. The ridiculous position at the moment is illustrated by the fact that when the new quota period, April-June, was opened on April 1, the "other countries" lead and zinc quotas were filled on the first day, as were the quotas for Italian zinc, "other countries" zinc ore, and Bolivian lead ore, and substantial entries were made against almost all other quotas. This state of affairs can hardly be looked upon as helping to stabilize prices, as the rush at the beginning of each three-monthly period must have some kind of impact at the time.

Following on the increase in production in the United States shown last week, the zinc statistics for March also show an increase in production from 71,174 s.tons in February to 79,918 s.tons in March, but at the same time total shipments rose from 66,490 to 74,296, and the total stocks on hand showed a relatively small increase from 200,461 to 206,083. In Europe, the pressure of nearby metal seems to have abated for a time, and with consumer demand remaining at a level rate, the present price level appears to be stable. Any increase in supplies will change the picture rapidly.

On the market itself business has been completely routine, the majority of turnover being accounted for by the prolongation of existing open positions. This state of affairs is likely to continue until after the results of the New York meeting are known at the end of the month. In this respect the majority opinion continues to favour the view that nothing concrete will emerge, as few countries are likely to be willing to agree to the introduction of production cutbacks and/or export quotas in view of the very different states of their various industries.

Closing prices are as follows:

|                 | April 9     |         | April 16    |         |
|-----------------|-------------|---------|-------------|---------|
|                 | Buyers      | Sellers | Buyers      | Sellers |
| <b>COPPER</b>   |             |         |             |         |
| Cash ..         | £244½       | £244½   | £229½       | £229½   |
| Three months .. | £244½       | £244½   | £229½       | £230    |
| Settlement ..   | £244½       |         | £229½       |         |
| Week's turnover | 11,525 tons |         | 18,725 tons |         |
| <b>LEAD</b>     |             |         |             |         |
| Current ½ month | £68½        | £68½    | £67½        | £68     |
| Three months .. | £69½        | £69½    | £69½        | £69½    |
| Week's turnover | 5,750 tons  |         | 7,375 tons  |         |
| <b>TIN</b>      |             |         |             |         |
| Cash ..         | £782        | £782½   | £781        | £782    |
| Three months .. | £784½       | £785    | £782        | £783    |
| Settlement ..   |             | £782½   |             | £782    |
| Week's turnover | 385 tons    |         | 210 tons    |         |
| <b>ZINC</b>     |             |         |             |         |
| Current ½ month | £71½        | £71½    | £71½        | £71½    |
| Three months .. | £71½        | £71½    | £71½        | £71½    |
| Week's turnover | 5,500 tons  |         | 8,350 tons  |         |

London Metal and Ore Prices appear on inside back cover.

## Mining Finance

## Another Look at the Randfontein Report

The Randfontein Estates annual report with its disclosure of uranium recovery costs provides an interesting exercise in attempting to assess the company's post-contract potential. It is the Union's biggest uranium producer—1,871,000 lb. last year.

The actual cost of uranium recovery is 10s. 6d. per ton treated and since the grade is 1 lb. per ton, this figure is also the cost per lb. Actual mining costs are 80s. 8d. per lb. and uranium recovery costs 10s. 6d., making 91s. 2d. per lb. From this must be deducted 17s. 11d., being revenue from by-product gold and other items, leaving a net figure of 73s. 3d. Revenue from uranium, which includes 9s. 3d. for redemption of plant loans, works out at 94s. 4d. per lb.

At first glance, it might be suggested that Randfontein's position in a "free" market, with uranium oxide at \$8 (£2 17s.), would not be particularly bright. A closer investigation, however, points the other way.

The first point is that the uranium contract price is on a "cost-plus" basis. There is no question of extravagance in regard to costs, but it is only rational that the contract price should bear as much as possible with an eye to savings in the future. In the breakdown of expenditure, development is roughly 20s. per lb. It seems obvious from this that a major programme of excess development is being maintained. This being the case, the post-contract period should see a sharp drop in this figure with a consequent reduction in costs. Taking West Rand Cons., the neighbouring property, as a yardstick, the ultimate development expenditure at Randfontein could be around 10s. per lb. This, plus other savings, might give a fair cost figure of 60s. eventually. To cover this, with a uranium price of £2 17s., the grade would have to be just above the present 1 lb. per ton. The question is, therefore, whether Randfontein can raise its grade, and the answer is a definite affirmative. Last year's mill throughput was 1,870,000 tons, derived from 3,810,000 tons mined. Consequently, the run-of-mine ore being drawn upon must run at around 0.5 lb. per ton. Current development values are of the order of 61 in. lb. Applying the stoping width of 33 in., the uncut grade is thus 1.85 lb., and the ore reserve is estimated to have an average value of 50 in. lb., or 1.5 lb. per ton.

The present policy of the mine must be to treat as much marginal ore as possible, both from the contract aspect and from the tax aspect, since uranium profits are taxed on the gold formula, which is aimed at encouraging the mining of as low-grade material as possible. In the post-contract period selective mining and intensive sorting can be applied to increase grade appreciably. For example, the mining of an average of 1 lb. ore would double the grade at the present rate of sorting, yielding a mill-head of 2 lb. At £2 17s. per lb., this represents 114s. per lb. revenue—10s. higher than at present. Moreover, no deduction would have to be made for amortization of plant, and working costs

would be lower by several shillings. There is also the possibility of a higher gold price, which would increase the present "sundry" revenue of 17s. 11d. per lb. of uranium.

## BREAKTHROUGH BY GENERAL MINING

General Mining, the South African mining finance house, is to be congratulated on its preliminary results for 1958. They show that the net profit rose by £352,080 compared with 1957 to £1,726,825 and that only £67,381 of last year's profit came from "share dealing". Moreover, this profit does not include the surplus that arose from the corporation's substantial participation in the deal whereby the finance houses supplied the new U.S. Kaffir trust, American-South African Investment, with its initial portfolio of gold shares. General Mining sold some £2,000,000 worth of shares to A.S.A.I.C. and from this, it is now announced, a profit of £870,260 was made. Under the special arrangement with the South African Government this profit will be tax free and it is notable that the corporation has seen fit to put the money to reserves.

It could do this without any unfairness to shareholders because the normal earnings have easily justified an increase of 1s. in the dividend to 6s. per £1 Ordinary with a final of 4s. against 3s. a year ago. General Mining has thus at long last broken through the 5s. dividend ceiling that had persisted since 1937 apart from the unexpected relapse to 4s. in 1956. Shareholders will be justified in expecting still better things in 1959 when the substantial investments in South Africa's new gold mines, which form such a large part of the portfolio, should continue to yield higher income while the corporation's liquid position should have greatly benefited from the A.S.A.I.C. deal. The unknown element in the situation, which will presumably be clarified in the full report or at the meeting, is in what direction the corporation is re-investing the proceeds from this deal.

The 1958 allocations to reserves are £845,390 to general reserve which got nothing a year ago and which should now stand at £3,000,000; £400,000 against £250,000 to investment reserve bringing this up to £1,000,000; and £150,000 against £50,000 to exploration reserve. In addition, £150,592 against £185,668 is appropriated for writing down investments. So, as may be seen, the Ordinary dividend, which requires a payment in all of about £867,000, is handsomely covered by the net profit which is £1,682,504 after deduction of the Preference dividends. The consolidated figure will probably be higher than this.

It is interesting to note that General Mining Ordinary at 132s. 6d., at which the yield is 4.7 per cent after allowing for the final in the price, stand above the level of 120s. at which the 6 per cent "A" Preference can be converted into Ordinary. It is possible that a certain

amount of conversion will now be going on, especially with the rising dividend prospect on the Ordinary. The right to convert every 12 "A" Preference of £1 each into two Ordinary of £1 expires on September 30 next.

## RIO TINTO PAYS LESS

As expected, Rio Tinto received less income from its investments last year largely owing to the drop in dividends from the substantial stake in the Rhodesian copper industry. Investment income, in fact, fell by £855,000 to £1,455,000 with the result that the gross profit is £744,000 lower at £3,156,000. There has, however, been a very sharp drop of £1,101,000 in the tax bill to £1,308,000, so the net surplus is actually £357,000 higher at £1,848,000. This is why there has been some disappointment with the cut in the dividend, which is 15 per cent on the 10s. stock units against 26 per cent a year ago, despite the fact that a special interim of 5 per cent declared on account of 1959 can in effect be taken as part of the 1958 payment. The 20 per cent so indicated would require the distribution of £894,000 out of an available profit of £1,386,000 after allowing for Preference dividends.

The profit is reduced to this amount owing to the fact that special credits are £104,000 lower on this occasion at £155,000 and two new debit items appear, £250,000 for amortization of Kern's oil reserves, and £284,000 attributable to minority interests. It should be emphasized that once again Rio Tinto's results do not include any income from the Canadian uranium operations, the further £722,000 accrued during 1958 remaining in suspense. This was the proportion of Rio Tinto of Canada's profits attributable to the parent company, but not yet available for distribution as dividends, because of the outstanding loan indebtedness. The total accumulated at December 31 last was £1,053,000.

It is this uranium element that forms such a question mark over the prospects for Rio Tinto, particularly as to when it is, in fact, going to bring some really worth-while distributable income into the company's coffers. Mr. Gerald Coke will no doubt have something to say about this in his annual statement early next month. At the moment the position in Canada is that Pronto has started dividends, and Algom should join it this summer. Milliken Lake is next in line, but the biggest operation of all, Northspan, has a burden of debt that is likely to preclude dividends for a long time ahead. In Australia, the Mary Kathleen uranium property is at the profit-earning stage, and will start dividends "at the earliest opportunity".

Meanwhile, there should be some recovery in Tinto's earnings from copper this year, and it is possible that if the uranium outlook is sufficiently buoyant there could be some improvement in the dividend above 20 per cent. When the uranium income starts to flow there certainly should be scope for materially

(Continued on page 426)



# ANGLO AMERICAN CORPORATION OF SOUTH AFRICA LIMITED

(Incorporated in the Union of South Africa)

## Extracts from the Statements by Mr. H. C. Koch, Chairman of THE GROUP'S RAND GOLD-MINING COMPANIES

(All companies mentioned are incorporated in the Union of South Africa)

### BRAKPAN MINES LIMITED

**T**HE tonnage milled increased by 138,000 tons to 1,492,000 tons. This included 216,818 tons drawn from surface waste rock dumps at the No. 2 and No. 3 Shafts, and 98,060 tons of sands which were made available by the recommissioning of the sands and flotation sections of the reduction works.

Despite the increase in the total tonnage milled, there was a reduction in the quantity of gold produced, the yield per ton milled being 2.66 dwt. per ton, which was 0.60 dwt. lower than in 1957. The reason for the reduction in the yield was the milling of a greater proportion of lower grade surface material. The average price realized on gold sold was 249s. 3d. per fine ounce, which was 5d. per fine ounce less than for 1957.

It follows that working revenue declined. However, the milling of a greater tonnage from the surface dumps also resulted in a lowering of working costs by £252,382 and, in consequence, working profit was only £30,301 lower at £151,454. Working costs per ton milled were reduced from 38s. 3.8d. in 1957 to 31s. 4.7d., which is the lowest figure achieved since 1948. This substantial reduction is almost entirely due to the increased substitution of surface material in the mill feed for ore from underground.

The working profit, together with net income from other sources and the unappropriated profit of £297,945 brought forward from 1957, made the total amount available for distribution £527,103. Appropriations for taxation and the Government's share of profits under the mining lease absorbed amounts of £4,778 and £11,815 respectively, and the two dividends of 4½d. and 6d. declared during the year accounted for £201,250. The balance of unappropriated profit carried forward to 1959 was £298,137.

The development footage advanced was again less than that accomplished in 1957 and totalled 34,726 feet, as compared with 48,129 feet. The percentage payability of the total footage sampled also declined during the year from 28.3 per cent to 23.2 per cent.

According to the consulting engineers' estimate at the end of the year, the combined total ore reserve on the Main Reef and the Footwall Reef had decreased by 426,900 tons to 1,940,000 tons. The estimated stope width was 1.83 inches greater at 52.81 inches and the stope value was 0.14 dwt. less at 4.85 dwt.

### EAST DAGGAFONTEIN MINES LIMITED

**T**HE tonnage milled totalled 1,096,000 tons. This was 32,500 tons less than the tonnage milled in 1957, and, while the average yield per ton milled remained constant at 3.31 dwt., the decrease in tonnage was responsible for a

decrease in the quantity of gold produced. Gold sold realized an average price of 249s. 3d. per fine ounce, which was 5d. per fine ounce less than for 1957.

These circumstances also led naturally to a decrease in the working revenue, and, despite a small reduction in working expenditure, to a corresponding decrease in the working profit, which was £64,050 lower at £349,763.

With the lower tonnage milled, the working costs per ton milled rose to 35s. 2d.

The working profit, together with net income from other sources and the unappropriated profit of £216,870 brought forward from 1957, made the total amount available for distribution £573,054. £128,570 was set aside against the company's estimated taxation liability, and appropriations for capital expenditure and directors' special remuneration accounted for a further £10,230. The two dividends of 7½d. each declared during the year absorbed £233,125, and this left an unappropriated balance of £201,129 to be carried forward to 1959.

In my last two annual reviews, I have drawn attention to the inevitable annual decrease in the amount of development footage driven as the remaining unstoped areas of the mine become fully developed. This decrease was in evidence again in 1958, both on the Main Reef Leader and the Kimberley Reef, the total footage developed on the two reefs being 23,911, compared with 32,623 feet the year before. The percentage payability of the total footage sampled also declined during the year from 38 per cent to 29.72 per cent.

According to calculations submitted by the company's consulting engineers, at the end of the year the estimated combined ore reserves on the two reefs decreased by 89,000 tons to 4,597,000 tons, with no material change in estimated stope widths and stope values, which were 36.61 in. and 4.51 dwt. respectively.

### SPRINGS MINES LIMITED

**T**HE tonnage milled decreased by 10,000 tons to 1,500,000 tons. Of the total tons milled 603,939 tons were drawn from surface dumps, which was 60,266 tons less than in the previous year. However, ore hoisted from underground and milled during 1958 increased by 57,720 tons and this greater proportion of ore from underground resulted in an improvement in the recovery grade from 2.22 dwt. to 2.31 dwt. of gold per ton. This, in turn, increased the quantity of gold produced, despite the slight fall in total milled tonnage. Gold produced during the year realized an average price of 249s. 3d. per fine ounce, which was 5d. per fine ounce less than the average selling price for 1957.

The lower average price received for gold sold was more than offset by the increase in quantity produced and ac-

cordingly working revenue increased by nearly £70,000. Working costs, on the other hand, rose by almost £76,000 with the result that the working profit for the year, at £93,538, was £5,859 lower than for the previous year.

The progressive reduction in the tonnage of ore hoisted from underground, coupled with the increase in the tonnage derived from surface dumps, was responsible for a reduction in working costs per ton each year from 33s. 7d. in 1954 to 26s. 7d. in 1957. During 1958, however, these trends were reversed and costs per ton rose to 27s. 8.9d.

The working profit, added to net income from other sources, including an amount of £24,852 from the disposal of fixed assets, and the unappropriated profit of £364,237 brought forward from 1957, made the total amount available for distribution £499,113. Appropriations to meet the estimated taxation liability and share of profits payable to the Government under the mining lease absorbed amounts of £10,398 and £10,923 respectively. Taking into account directors' special remuneration, and £189,562 for the dividend declared during the year, the unappropriated profit to be carried forward to 1959 was £280,730.

Development footage increased to 14,035 feet, as compared with 9,498 feet in 1957. While the percentage payability of the total footage sampled declined from 35.66 per cent to 31.83 per cent, the inch-dwt. figure improved from 437 to 479.

As estimated at the end of the year, the ore reserve had decreased by 455,000 tons to 1,510,000 tons. The stope width of the ore reserve, at 41.96 inches, was 0.56 inch less than in 1957, while the stope value improved by 0.10 dwt. to 4.39 dwt.

A major change during the year was the cessation of milling operations at the East reduction plant. Three tube mills and one crusher were transferred from that plant to the West reduction plant, the capacity of which was accordingly increased to approximately 105,000 tons per month. With the closing down of the East reduction plant, which took place in November, 1958, a much lower tonnage will be drawn from surface dumps and the total tonnage milled during 1959 is likely to be reduced by approximately 240,000 tons. This should have the effect of improving the grade, and this factor, together with an expected saving in costs brought about by the concentration of operations in one reduction plant, will assist in minimizing the effect on profits of the lower milling rate.

### DAGGAFONTEIN MINES LIMITED

**T**HE tonnage of ore milled during 1958 increased by 67,000 tons to 2,785,000 tons. As a result, however, of a decrease in the yield per ton milled from 4.35 dwt. to 4.14 dwt., there was a decrease in the quantity of gold produ-



ced, which, at 577.155 ounces, was 14,240 ounces less than in 1957. The average amount received for gold sold during the year was 249s. 3d. per fine ounce, which was 5d. per fine ounce less than the average selling price for 1957. In consequence the working revenue from gold production for the year fell by £199,505 to £7,240,269, and, with working costs only slightly lower at £4,177,487, the resultant working profit from gold was reduced by £184,550 to £3,062,782.

Working costs per ton milled showed a further improvement from 30s. 10.2d. to 30s. 0d.

A total of 1,523,056 tons of slimes was treated in the company's uranium plant during the year, of which approximately 80 per cent represented the tonnage treated from current mining operations, the balance being reclaimed from previously accumulated deposits on the slimes dams. The average recovery grade of uranium oxide per ton of slime treated was 0.38 lb. compared with 0.405 lb. for 1957.

Total revenue received from the sale of uranium oxide amounted to £2,357,781. Treatment costs incurred in respect of the quantity sold was £829,148 and the working profit was thus £1,528,633. In addition, the sale of sulphuric acid realized a working profit of £194,094.

Following the agreement made during 1958, in terms of which the Combined Development Agency's purchases of uranium oxide from South African producers was limited to 3,100 tons for the six months ended December 31, 1958, the company was given a sales quota of 286,130 lb. of uranium oxide for that period. The quantity to be purchased by the Agency in 1959 is 6,200 tons, of which your company's quota is 572,260 lb.

The total working profit from the production of gold, uranium oxide, and sulphuric acid for the year was £4,785,509, compared with £5,026,518 for 1957.

To this profit has been added sundry revenue of £170,177 and there has been deducted £111,454, paid as interest on the uranium loans, and other expenditure of £9,351. The surplus for the year was, therefore, £4,834,881, to which is then added the unappropriated profit of £371,019 brought forward from 1957, and an amount of £100,000 transferred from the uranium reserve, making the total amount available for distribution £5,305,900. Charged against this is £44,238 spent on fixed assets, £451,649 applied in redemption of uranium loans, £757,944 set aside to meet the Government's share of profits under the mining lease and £1,894,539 for taxation, £7,500 for directors' special remuneration and £1,750,000 for the two dividends, each of 2s. 6d. per share, declared during the year. This leaves an unappropriated balance of £400,030 to be carried forward to 1959.

While development footage advanced on the Main Reef Leader increased by 6,527 feet to 15,160 feet, there was a reduction of 5,081 feet in the development footage accomplished on the Kimberley Reef, to 15,328 feet. Of the footage sampled on the Main Reef Leader, the average percentage payability was 44.2 per cent compared with 35.1 per cent in the previous year, while the average percentage payability on the Kimberley Reef improved from 18.1 per cent in 1957 to 38 per cent in 1958.

The average value of uranium oxide per ton disclosed on the Kimberley Reef

in the footage which gave payable gold values was 28.18 inch lb., compared with 17.36 inch lb. in 1957.

Estimates prepared by the consulting engineers of the combined total ore reserve on the Main Reef Leader and the Kimberley Reef at the end of the year reflect a decrease of 460,500 tons to 9,786,000 tons, of which 4,015,700 tons were on the Kimberley Reef. The estimated stoping width of the total ore reserve was virtually the same at 43.19 inches, and the estimated stoping value was 0.20 dwt. less at 5.16 dwt.

In addition, accumulated uranium-bearing slimes remaining in the Kimberley Reef slimes dams were estimated at 2,184,000 tons, with an estimated average value of 0.4 lb. of uranium oxide per ton.

Total capital expenditure in 1958 was £44,238, of which £36,702 was in respect of the uranium and sulphuric acid plants. During the year uranium loans were reduced by £451,649. Estimated capital expenditure for 1959 is £86,000.

#### THE SOUTH AFRICAN LAND AND EXPLORATION COMPANY LIMITED

**T**HE tonnage milled was 1,079,000 tons, approximately the same as in 1957. The yield per ton milled, however, was 0.07 dwt. lower and consequently the quantity of gold produced was 2,056 ounces lower at 222,470 ounces. The average price realized for gold sold was 249s. 3d. per fine ounce, which was 5d. per ounce less than the average selling price for 1957.

These circumstances led to a decrease in the working revenue of £32,003 while working costs increased by £38,540. The resultant working profit was accordingly £70,543 lower at £655,168.

The working profit, together with net income from other sources and the unappropriated profit of £398,383 brought forward from 1957, made the total amount available for distribution £1,055,993. An amount of £152,804 was set aside against estimated liability for taxation and the Government's share of profits under the mining lease, £20,639, was appropriated for capital expenditure and £7,554 for directors' special remuneration, and the two dividends of 1s. 6d. each absorbed a total of £371,250. This left a balance of unappropriated profit of £503,746 to be carried forward to 1959.

The amount spent on "fixed assets" in 1958 was £249,858. Of this amount, £20,639 was spent in the existing lease area and was appropriated from current profits. The balance of £229,219 was the amount spent on exploratory development work on the Withok property, and by the end of the year the total amount spent on this property, including its purchase, had reached the sum of £886,842.

This expenditure has been met partly by the use of cash resources available and partly by drawings under the loan facilities of £1,281,250 provided by Anglo American Corporation of South Africa, Limited. At the end of December, 1958, these drawings, with interest accrued, amounted to £92,011. The Anglo American Corporation loan facilities are now the principal source of finance for the exploratory development work being carried on in Withok.

On November 18, 1958, a circular was issued describing the work done on Withok and notifying shareholders that, since this work had not yet produced the information required to enable the direc-

tors to formulate definite proposals for the opening up of the property, the offer of shares to members at December 31, 1958, would not be proceeded with. I am hopeful that the directors will be in a position by the middle of 1959 to formulate such proposals.

In the existing lease area, the footage accomplished during 1958 declined to 20,772 feet, but of the footage sampled 42.2 per cent was payable, as compared with 36.7 per cent in 1957. The value of the payable reef was approximately the same at 446 inch dwt.

The area lying between the existing lease area and the Vogels tear fault may be looked upon simply as an extension of the lease area itself. The footage driven in this area amounted to 6,925 feet during 1958 and, of the 5,365 feet sampled, 51.5 per cent was payable at a value of 554 inch dwt. Most of this footage was accomplished in a relatively small area in the north-eastern corner of Withok, where values are generally higher than average.

In the area south of the fault, the amount of payable ore cannot be assessed until a great deal more exploratory development work has been done. The footage driven in this area in 1958 totalled 20,438 feet. Most of this was in country rock, and only 1,005 feet were sampled, showing a payability of 22.9 per cent with a value of 300 inch dwt.

The estimated ore reserve in the company's mining lease area at the end of the year had decreased by 124,600 tons to 3,518,500 tons. Stopping width and stopping values of the ore reserve were both slightly higher at 44.45 inches and 5.74 dwt.

#### SEREMBAN, LTD.

The thirty-sixth annual general meeting of Seremban, Limited, was held on April 8, in London.

**Mr. W. E. Hosking** presided and the following is an extract from his circulated statement:—

It is with very great regret that I have to inform you of the death on January 20, 1959, of the Chairman of your Company—Mr. Donald W. Thomas. Mr. Thomas was a Director of and Legal Adviser to the Company for over twenty years, and since 1953 and until his death he was Chairman of the Board.

During the year ended June 30, 1958, the unfavourable security conditions which have prevailed since the war in the area in which your mine is situated have gradually improved and the district is now almost normal. Unfortunately, however, in view of the provisions of the International Tin Agreement and the Tin Control Regulations, 1955, it has not been possible to claim a satisfactory production assessment for your Company, and in consequence there has been no tribute receivable during the year under review.

From the Accounts it will be seen that the Adverse Balance on Profit and Loss Account brought forward as at June 30, 1957, was £2,603, to which is added United Kingdom Income Tax on interest received, less recoverable, £252. The resulting total of £2,855 is reduced by £613—the profit for the year under review—leaving an Adverse Balance of £2,242 to be carried forward to the next Account. The profit referred to arose by reason of interest received on investments and bank deposits.

The report and accounts were adopted.

**MINING FINANCE—Continued**

higher payments. The 10s. stock units stand at 51s. 3d. to yield 4 per cent.

**TIME OF DECISION FOR SALLIES**

Most of the East Rand companies of the Anglo American group (chairman's statements on page 424) are now well into their maturity. S.A. Lands is one of these companies but whereas operations at most of the others are now in a declining phase Sallies, like much of mankind, has developed a middle aged spread.

In his statement to Sallies' shareholders, Mr. H. C. Koch reiterates the hope that the directors will be able to formulate definite proposals by mid-1959 for the opening up of the Withok area (acquired in 1956) immediately to the south of the Eastern Rand gold mine. It may be recalled that a new share issue for the financing of this development had been planned for the end of 1958, but this was not proceeded with owing to results from Withok having been discouraging.

The position is that in the north-eastern part of Withok the reef is opening up in much the same way as it has done in the original lease area. This was to be expected. It is, however, south of a major fault, called the Vogels tear fault, that doubts arise. The strata have undergone a lateral thrust of about 3,000 ft. and Mr. Koch says that the amount of payable ore south of the fault cannot be assessed until a great deal more exploratory development work has been done. Out of 20,438 ft. driven in this area last year only 1,005 ft. of reef were sampled showing payability of 23 per cent and values of 300 in. dwt.

The extent of the payable reef in Withok is very important for Sallies' future life prospects. So far, Withok has cost £886,842 and the company is fortunate in that it has been able to finance it while borrowing only £92,011 from Anglo American Corporation. It has loan facilities of up to £1,281,250 from the parent finance house and the warning is given that these facilities must now be the principal source of funds for the exploration of Withok.

Shareholders may not relish the thought of being called upon for fresh capital, which would be needed for the exploitation of the Withok area beyond the fault, but it will be a good thing for Sallies' long-term prospects if the ground were to prove economic.

Sallies are currently quoted at 20s. 6d. Any new issue would on this basis have to be planned at well below the price of 25s. that was decided upon for the original issue as long ago as September, 1956. Dividends totalling 3s. were paid for 1958.

**GLOBE AND PHOENIX PUZZLE**

The announcement of an interim for 1959 of 5s. per 5s. stock unit by Globe and Phoenix Gold Mining, the Southern Rhodesian producer, seems to have caused some confusion. At first, the market tended to assume that this declaration was directly comparable with the 2s. 6d. payment a year ago which was followed last September by a second interim of like amount. Then it was noticed that for 1957 there were three interims in April, June and September and, what is more, a final in March, 1958. And it was also recalled that a

few years ago it was the company's rather unusual practice to declare about April one interim for the whole of the year to the following December 31. There would be no subsequent dividend on account of that particular year.

It is possible that Globe has now reverted to this practice. In which case the totals for 1957, 1958 and 1959 will all be the same at 5s. despite their having been paid in different fashion. Whether or not there is anything more for 1959 it would be safest to value the units on the basis that there will not be. It is not as though there has been any sharp increase in earnings. Working profit from the mine for the first quarter of 1959 has been much the same as that for the first three months of last year. Globe are 31s. 3d. ex dividend to return 16 per cent on a 5s. per annum basis. They are a reasonable holding as a yield sweetener, although there must always be some element of doubt about the life prospect.

**Rix-Athabaska Reduces Costs.**—As a result of the higher tonnage milled during 1958, Rix-Athabaska Uranium was able to reduce unit costs substantially. For the six months April-September costs averaged \$12.78, and over the whole year the average was \$14.02. Net operating profit for the year was \$299,782. A dividend of 5 c. per share declared in December absorbed \$200,000 of this.

**LONDON MARKET HIGHLIGHTS**

A very cautious start to the week was made by the South African gold share market. Considerable apprehension appeared to be felt in front of the March quarterly reports in the cases of Stilfontein and Hartebeest. The former dropped to 42s. before rallying to 42s. 9d., and the latter at one time fell to 63s.

Free State Geduld again dominated the scene, but this share was also subject to some uneasiness in front of the quarterly. The price dipped to 170s. 7½d. before rallying on the eve of the quarterly report to 175s. When the return appeared, the shares bounded ahead to 181s. 10½d. This was despite some switching into Western Holdings which, on the good news in their report, sailed ahead to a record high of 150s. 7½d., a rise in three days of 10s. 7½d.

All this stimulated the rest of the O.F.S. market, and substantial gains were soon recorded in Blinkpoort (91s. 3d.), "Ofsits" (95s.), and Lydenburg Estates (19s.).

In the Far West Rand group, Vaal Reefs (39s.) attracted attention to themselves by the disclosure that their uranium treatment costs, before allowing for loan repayment and interest, amount to only 19s. 7d. per lb. of oxide. This was the lowest cost figure so far released, and only Hartebeestfontein among South African uranium producers should be able to beat this.

General Mining, in the Finance group, raised their dividend by 1s. to 6s., and the market reacted appropriately by raising the price of the shares nearly 4s. to 135s. Union Corporation attracted support on a collection of vague rumours varying from talk of an approaching new flotation in the Kinross area to theories that they had at last obtained Treasury consent to a change of domi-

**Coming Events**

The annual dinner of the Camborne School of Mines is to be held at Tonkin's Restaurant, Camborne, Cornwall, on May 15, 1959.

One of the features of the International Samples Fair which opens this Sunday in Milan for a fortnight will be a nuclear energy building in which nine nations are demonstrating their atomic advances. The United Kingdom Atomic Energy Authority has one of the largest exhibits in this section, covering 3,500 sq. ft.

The annual meeting of the Institution of Mechanical Engineers will be held at 1 Birdcage Walk, Westminster, London, S.W.1, on April 24, 1959, at 6 p.m.

When the British Exhibition opens on June 10, 1960, at the Coliseum Building in New York, Britain plans to put on a striking demonstration of advanced science, technology, and engineering. Sir Norman Kipping, director-general, Federation of British Industries, and Mr. W. P. N. Edwards, a director of F.B.I., have gone to the United States to make preliminary arrangements for the exhibition.

cile, and since the shares looked reasonably priced on their investment merits alone, they soon moved up to 55s. 3d. Cape buying, inspired by hopes of a better demand for the metal, lifted platinum issues. Lydenburg rose to 11s. 3d. and "Pots" to 8s. 4½d.

Copper shares could hardly have been expected to be other than dull in view of the shake-out in the metal price. But the share market was brightened on Wednesday by the sharply increased interim from Messina, the shares of which spurted 4s. 4½d. to 120s. Previously, Rio Tinto, which had fallen to 48s. 9d. on their lower dividend, later recovered to 51s. 3d. Chartered, after easing to 83s. 9d., improved to 85s. on renewed investment support.

Tin shares continued to edge higher under the stimulus of the recent batch of interim dividends and a firm metal price. Southern Kinta (22s. 4½d.) and Gopeng (12s. 10½d.) were among those to establish new highs for the year. The merger proposals left United Tin and Ribon Valley unmoved at 7½d. each. Anglo-Burma, on the other hand, were quickly marked up to 4s. 6d. on the counter-bid from Anglo-French.

After falling to 60s. on end-Account selling, Consolidated Zinc staged a recovery to 62s. Mount Isa were steadily bought by their ever-present Australian following and the price climbed to 34s. The yield at this price dwindles to under 1.5 per cent, but potential buyers are more interested in Mount Isa's undoubted growth possibilities, particularly now progress is being made towards getting the Mount Isa-Townsville railway rehabilitated. Elsewhere, Globe and Phoenix jumped to 32s. 6d. on the 1959 interim of 5s.—but whether this will be followed by a final remains to be seen.

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## Equipment for Canada

The United Kingdom Trade Commissioner at Montreal has reported that within approximately the next two weeks a new company, Quebec South Shore Steel Co. (QUESSO), is expected to be formed to produce 100,000 tons of low sulphur foundry-grade pig iron and/or semi-steel per year at Varennes, P.Q. (on the St. Lawrence River immediately south-east of Montreal Island), from raw ore (about 45 per cent Fe) mined at Hull, P.Q., using the Strategic-Udy smelting process. Major items of equipment to be bought will include: raw materials (mainly ore, coal, and limestone), stockpiling and mechanical handling equipment; primary crushing plant and blending bins; weigh hoppers; tertiary crushing plant (4 in.); dryer and pre-heater, 8 ft. dia. by 100 ft. long, using as fuel the exhaust gases from the kiln and whatever excess furnace gas may be available; dust collector; pre-reduction (controlled temperature) kiln, 11 ft. dia. by 300 ft. long; hot-charge mechanical handling equipment and gantry; 20,000 kVA. pig iron furnace; hot-metal handling equipment, including 50-ton gantry crane; desulphurization furnace (probably a standard 40-ton electric steel furnace); pig machine and pig shipment loading facilities. Baked carbon (not graphite) electrodes and coal and anthracite (not coke) are used in the Strategic-Udy process. Construction of the plant at Varennes is expected to commence in June this year. Senior technical representatives of United Kingdom firms seeking to supply major equipment should contact Mr. Frank Senior, Acting General Manager, Strategic-Udy Metallurgical and Chemical Processes Ltd. (SUMAC for short) at 3527 Stanley Avenue, Niagara Falls, Ontario (telephone Elgin 4-5655). Turnkey contractors will be Koppers Co. Inc., Pittsburgh 19, U.S. Telephone inquiries to Chancery 4411, extension 776 or 866.

## Publications Received

The next publication of the Gauge and Tool Makers' Association is to be entitled *A Simple Guide to Prospective Exporters*. The booklet has been prepared by the Export Committee of the Association in consultation with a number of the principal exporting houses in Great Britain.

An authoritative new course is now being offered by the Metals Engineering Institute, a division of the American Society for Metals. It is called "Iron Blast Furnace Operations", and covers all aspects of blast furnace technology, both from the research standpoint and from the viewpoint of the actual operating process. Details on "Iron Blast Furnace Operations", or any of the seventeen other courses on metals subjects in the M.E.I. curriculum, may be secured from Metals Engineering Institute, Dept. NR-3, American Society for Metals, 7301 Euclid Avenue, Cleveland 3, Ohio, U.S.A.

*This feature  
appears every  
fourth week*

The new issue of *Quin's Metal Handbook* is the forty-fourth edition and comprises 600 pages. Every effort has been made to make the volume as comprehensive as possible. It contains a wealth of information on ores, metals, iron and steel, and scrap, and is concisely indexed for quick and easy reference to any metal in any part of the world. The 1958 edition costs £1 7s. 6d.





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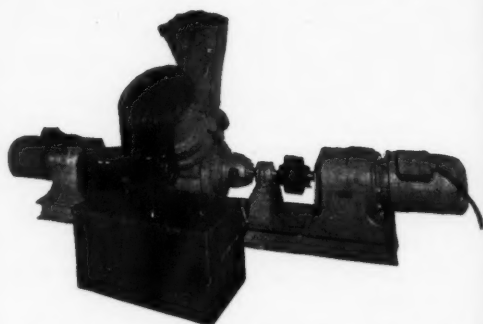
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